EXPRESS MAIL NO. EV348170815US

#15 P. Allen 10/7/03

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Jordan J. Hopkins et al.
Application No.	:	10/038,507
Filed	:	January 2, 2002
For	:	COMPONENTS, SYSTEMS AND METHODS FOR FORMING A GASKETLESS SEAL BETWEEN LIKE METAL COMPONENTS IN AN ULTRAHIGH PRESSURE SYSTEM

Examiner	:	James M. Hewitt
Art Unit	:	3679
Docket No.	:	340058.544

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION OF JORDAN J. HOPKINS

UNDER 37 C.F.R. § 1.132

Commissioner for Patents:

I, Jordan J. Hopkins, declare and state as follows:

1. I am an inventor of the above-identified patent application ("subject application").

2. I have a Bachelor of Science degree from Carnegie Mellon University.

3. I have worked in the field of mechanical engineering since 1997 (over 6 years), and have particular expertise in designing, analyzing, and testing ultrahigh pressure vessel systems and components.

4. I have been employed by Flow International Corporation from 1997 to the present date.

5. I am familiar with the prosecution history of the subject application. I have further reviewed the references cited by the Examiner in the present Office Action (including Hashimoto, U.S. Patent No. 5,172,939; Kato, U.S. Patent No. 5,667,255; Sugino et al., U.S. Patent No. 6,045,165; and Mott et al., U.S. Patent No. 4,817,962).

6. As an expert in the design, analysis and testing of ultrahigh pressure systems, I believe that certain of the characterizations of the cited references, and conclusions drawn therefrom, as set forth in the present Office Action are incorrect.

7. Based on my understanding of the technology, my review of the cited references, and my experience with ultrahigh pressure sealing systems and components, I believe that at the time we conceived of the present invention there was no reasonable expectation that we would successfully achieve an effective sealing configuration between two axisymmetric components compressed together axially and subjected to ultrahigh pressures in excess of 15,000 psi and that would substantially reduce the component stresses and eliminate any relative motion between the components. Although we could seal components in the past, we could not obtain satisfactory performance over long durations. We have since discovered that reducing the component stresses increases the life of the sealing components and can greatly decrease maintenance costs. Further, eliminating the relative motion between the components greatly reduces wear and damage due to galling, spalling, and/or fretting and prevents the onset of fatigue initiation sites. Neither of these problems are taught nor resolved by the references cited by the Examiner. The fact that myself and my coworkers were able to ascertain that relative motion could be diminished as a function of the angle and curvature of the mating surfaces was fortuitous. Only after many experiments and finite element analysis modeling did we find that the inventive angle of the mating surfaces relative to the radial axis could substantially reduce, if not eliminate, any relative motion between the components during pressure cycling. None of the references cited by the Examiner, either individually or in combination, teach or suggest the configuration of design parameters and component interaction as disclosed and claimed in the subject application.

8. Shortened seal life can be caused by relative motion, high contact stresses, or both, and has been a persistent problem in the design of ultrahigh pressure systems. Although dissimilar metals are commonly employed in the sealing region, this necessitates that one of the materials will be of lower strength, thus decreasing the capacity of the overall system or requiring frequent replacement of the lower strength material. Hashimoto does not teach or suggest toward any approach of reducing the relative motion between the components as a function of the surface profile or the angle of the mating surface relative to the radial axis. Given the common practice of using a lower strength material in the sealing region, a common acceptance that frequent replacements were to be expected, and the uncertainty as to whether the mating surface contact configuration could be beneficially optimized, one skilled in the art would not have considered embarking on an extensive testing program to verify the benefits of a certain range of contact angles and the configurations of the cross-sectional profiles of the mating surfaces.

9. I have reviewed the Hashimoto reference and in my opinion, I believe that Hashimoto's teaching that the curvature radius of the pressure bearing surface (18) is to be within a range of $0.4D \leq g \leq 10D$ (column 3, lines 31- 42) is merely to ensure that the curvature radius is large enough to withstand the force (tightening torque) exerted from the nut (7), that is, the force transmitted by the terminal end of the branch pipe (6) is sufficiently distributed over the pressure receiving bearing surface (3') of the main pipe (1). In addition, Hashimoto discloses that if the curvature radius is too large than any self-rectifying action will be negated. The self-rectifying action is when the branch pipe (5) is initially installed against the main pipe at an angle other than perpendicular. The curvature radius, upon contact with the pressure receiving bearing surface and with appropriate tightening torque, will have a tendency to self-rectify such that the branch pipe ends up substantially aligned in a perpendicular manner with respect to the main pipe. Other than the two reasons just mentioned, Hashimoto does not disclose, teach, or suggest any other rationale for geometrically configuring the mating surfaces of two components in a pressure system.

10. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further

that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

9-10-03
Date

Jordan J. Hopkins
Jordan J. Hopkins

406711_1.DOC